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Research Article
Association Between Age, Gender and Body Weight in Educational Institutions in Ota, Southwest Nigeria

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Abstract

Background and Objective: There is paucity of data on the association between body weight and age or gender in Nigeria. This study investigated the body weight distribution amongst sexes and different age groups in educational institutions in Ota, Southwest Nigeria. **Materials and Methods:** The participants, 1394 (609♂; 785♀) healthy persons, were randomly selected from four schools in Canaanland, Ota and divided into six age groups: 2-5, 6-12, 13-19, 20-39, 40-59 and 60-75 years. Body weight was categorized into normal weight, underweight, overweight and obesity using CDC age and sex-specific BMI cut-offs for 2-19 years and WHO cut-offs for 20 years and above. Strength of association was assessed by correlation and regression analyses. **Results:** Underweight was prevalent at early childhood (22.7%) whereas obesity was predominant at middle adulthood (26.4%). Correlation was strong ($p<0.001$) between age and the anthropometric parameters: Weight (0.696); height (0.317); BMI (0.612) and body weight category (0.200). Gender had significant correlation with weight (-0.314, $p<0.001$) and height (-0.056, $p<0.005$). Body weight correlated more with age compared to gender. **Conclusion:** Age and gender had significant influence on the body weights of the studied population and could be factored into the national scheme for health and nutritional improvement.

Key words: Body weight, BMI, weight abnormality, correlation, health and nutrition

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Global adiposity pandemic has heightened the nutritional challenges facing developing nations. This has resulted in currently grappling with the burden of obesity and underweight[1-4]. Body weight abnormalities, also known as abnormal or unhealthy body weights, have continued to attract the attention of researchers and public health advocates because of their association with adverse health outcomes including cardiovascular diseases, diabetes and mortality[5-9]. Obesity, a product of over-nutrition often linked to wealth and affluence, was formerly thought to be alien to Nigeria until recently when reports of obesity scourge, almost in epidemic proportion, began to emerge[10-12]. In spite of the escalating adult obesity, underweight still persists amongst Nigerian children[13]. This suggests an age related disparity in body weights of Nigerians. There is, therefore, a need to investigate the relationship between body weight and age as well as gender in Nigeria. An understanding of the body weight pattern in relation to age and gender will provide the basis for a proper review of the policy of nutritional and health improvements in Sub-Saharan Africa which had for several decades centered on poverty and under-nutrition[14]. In this study, the correlation between age, gender and body weights and the trend in body weight abnormality in educational institutions located at Canaanland in Ota, Southwest Nigeria was investigated.

MATERIALS AND METHODS

A total of 1394 healthy persons, 609 (43.7%) males and 785 (56.3%) females, participated in the study conducted from 2014-2015. The participants were randomly selected amongst pupils, students and staff of four educational institutions in Canaanland, Ota: Kingdom Heritage Model School (Crèche, Nursery and Primary), Faith Academy (Secondary), Covenant University Secondary School (Secondary) and Covenant University (Tertiary). They were grouped into: 2-5 years (early childhood), 6-12 years (late childhood), 13-19 years (adolescence), 20-39 years (early adulthood), 40-59 years (middle adulthood) and 60-75 years (advanced adulthood) as shown in Table 1. They constituted over 10% of 13,500 Canaanland's residents and were drawn proportionately from different age groups and gender. Height, weight, age and sex were studied. Weight (kg) was measured to the nearest 0.01kg using Produex™ digital balance, Springfield, USA. Height (m) was measured to the nearest 0.001 m using a standard meter rule with the subject standing upright, barefooted and without a cap or headgear. BMI was calculated as weight (kg)/height (m^2). Body weight category of persons aged 2-19 years was defined based on CDC age and sex-specific BMI cut-offs for children and adolescents[15] as follows: Underweight (BMI<fifth percentile), normal weight (BMI>fifth percentile< eighty-fifth percentile), overweight (BMI>eighty-fifth percentile<ninety-fifth percentile) and obesity (>ninety-fifth percentile). Body weight of persons aged 20 years and above was defined using WHO cut-offs[16] as follows: Underweight (BMI<18.4 kg m^{-2}), normal weight (BMI>8.5<24.9 kg m^{-2}), overweight (BMI>25.0 <29.9 kg m^{-2}) and obesity (BMI> 30.0 kg m^{-2}). Data were analyzed with SPSS software; strength of association was assessed by Pearson correlation and linear regression analyses.

Statistical analysis: Data were analyzed with IBM SPSS statistics (version 23.0 software for Windows; IBM Analytics, Armonk, NY); strength of association was assessed by Pearson correlation and linear regression analyses considered significant at a 95% probability level.

RESULTS

The height, weight and BMI of the subjects are shown in Fig. 1a-c. In both sexes, height, weight and BMI increased with age and declined after attaining the peak value. There was no significant difference in the height and weight amongst the sexes in early and late childhood. However, from adolescent

Table 1: Percentage distribution of participants according to age and gender

			Gender		
Groups	Age (years)	Classification	Male (%)	Female (%)	Sub-total
1	2-5	Early childhood	2.4	2.4	4.8
2	6-12	Late childhood	7.7	10.0	17.6
3	13-19	Adolescence	15.6	29.8	45.3
4	20-39	Early adulthood	13.9	10.6	24.5
5	40-59	Middle adulthood	3.6	2.9	6.5
6	60-75	Advanced adulthood	0.6	0.7	1.3
		Total	43.7	56.3	100.0

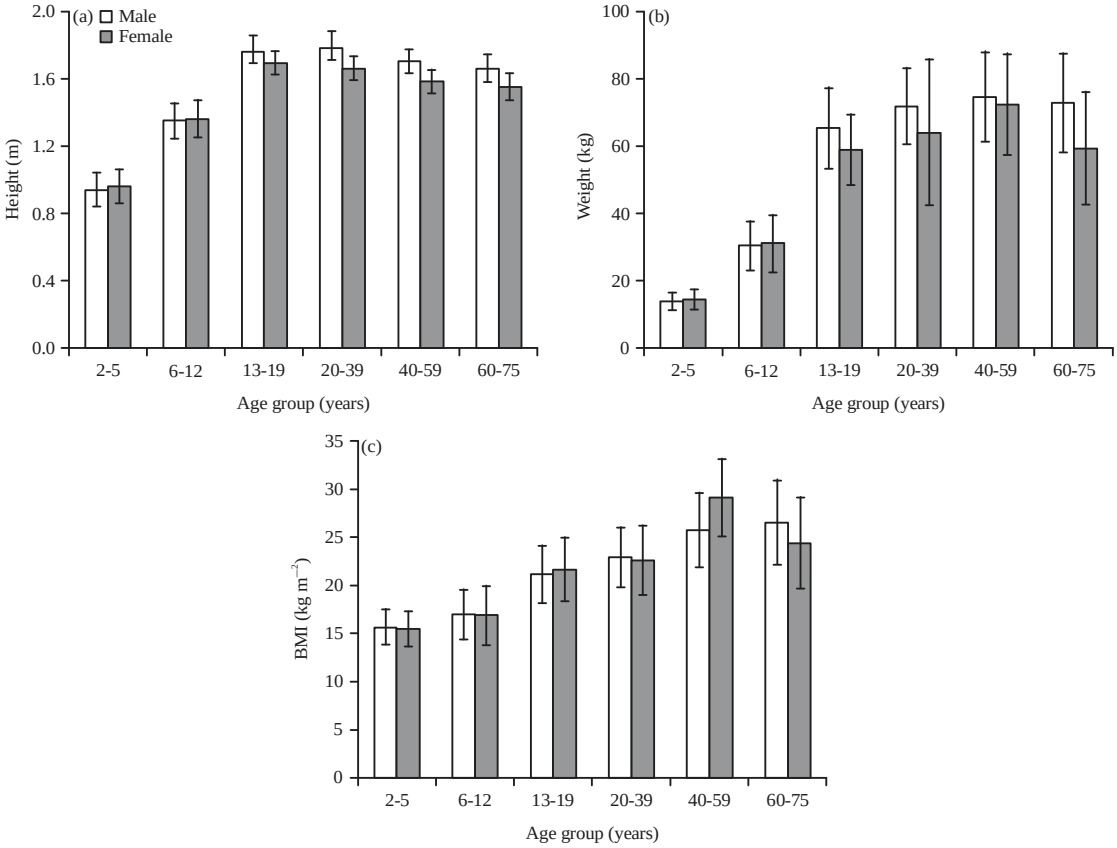

Fig. 1(a-c): Anthropometric measurements, (a) Height, (b) Weight and (c) BMI of subjects
Values are expressed as Mean±standard error of mean

stage upwards, males were significantly ($p<0.05$) taller and heavier than the females. Peak height was 1.78±0.07 and 1.69±0.72 m, respectively for males and females while 74.30±13.28 and 72.09±15.04 kg was the peak weight for males and females, respectively. BMI was not significantly different amongst the sexes except at middle adulthood where females had significantly higher values than males. Mean BMI was least (15.49±1.83 kg m^{-2}) at early childhood and highest (27.15±5.27 kg m^{-2}) at middle adulthood. Normal body weight was highest (81.8%) at adolescence and least (27.5%) at middle adulthood. The prevalence of abnormal body weights at different age brackets shown in Fig. 2a-c. Underweight was highest at early childhood with a prevalence of 27.3% males and 18.2% females. Overweight had the highest prevalence of 52.0% at middle adulthood for males and 40.0 at advanced adulthood for females. The prevalence of obesity was 41.2% for females at middle adulthood and 25.0% for males at advanced adulthood. The trend in body weight abnormality according to age was shown in Fig. 3. Underweight progressively decreased in prevalence from a peak value of 22.7% at early childhood to the least value of 1.1% at middle adulthood. In contrast, overweight and obesity increased in prevalence after adolescence and early adulthood to their peak values at middle adulthood. At advanced adulthood, prevalence of overweight and obesity declined while that of underweight increased. Summary of the Pearson correlation and regression analyses result is shown in Table 2. There was strong positive correlation ($p<0.01$) between age and each of the four variables: Weight (0.696), height (0.317), BMI (0.612) and weight category (0.200). Correlation was significant between sex and two of the variables: Weight (0.314) at $p<0.001$ and height (0.056) at $p<0.005$. Linear regression analysis showed that age influenced weight (0.000), height (0.000), BMI (0.000) and body weight category (0.001) whereas gender influenced only the weight (0.000) and BMI (0.000) of the subjects.

DISCUSSION

Height, weight and BMI increased almost in a proportionate manner with age and declined after the peak value was reached. Females reached their peak height in

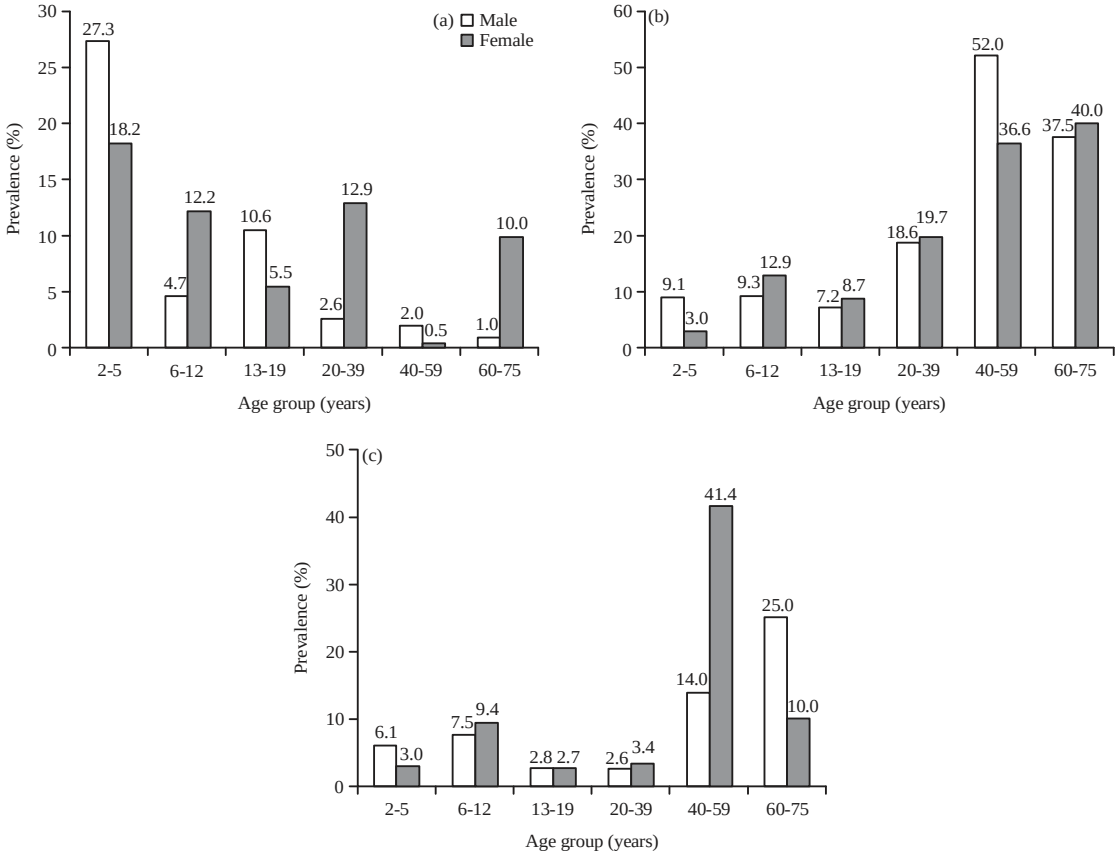

Fig. 2(a-c): Prevalence of abnormal body weight amongst the subjects, (a) Underweight, (b) Overweight and (c) Obesity

Fig. 3: Trends in 'abnormal' body weight amongst the subjects (Age group: 1 = 2-5 years, 2 = 6-12 years, 3 = 13-19 years, 4 = 20-39 years, 5 = 40-59 years, 6 = 60-75 years)

adolescence while the height for males peaked at early adulthood. Anthropometric measurements remain a simple, acceptable indicator of wellness, maturation and development at different age groups in humans[16,17]. Increase in stature is part of the normal human development and maturity processes; females are known to attain physical maturity earlier than males of their age. Average BMI was low at childhood, normal at adolescence and at early adulthood and high at middle and advanced adulthood. This is consistent with reports of high prevalence of underweight in early childhood and obesity at middle adulthood in Nigeria[9,13].

The prevalence of each body weight category varied with age. Normal body weight was most prevalent (81.8%) at adolescence and least (27.5%) at middle adulthood. This implies that while adolescence is the healthiest age group, middle adult stage represents the most vulnerable segment of the population. This may be due to the fact that while young persons are physically active, the older ones are less active and tends to assume a sedentary lifestyle; at 40 years and above, most persons have passed the peak of their physical strength and biological functions[18]. This is the age senescence and associated health challenges naturally set in Shephard[18].

There was disparity amongst the sexes and age groups on the prevalence of abnormal body weights (Fig. 3). Underweight was most prevalent at early childhood (2-5 years); it was more in males (27.3%) than females (18.2%). This may be attributed to the problem of nutrient deficiency,

Table 2: Correlation analyses of data

	Weight	Height	BMI	Body weight category
Age				
Pearson correlation	0.696**	0.317**	0.612**	0.200**
Sig. (2-tailed)	0.000	0.000	0.000	0.000
N	1394	1394	1394	1394
Sex				
Pearson correlation	-0.134**	-0.056*	0.003	0.002
Sig. (2-tailed)	0.000	0.035	0.907	0.955
N	1394	1394	1394	1394

**Correlation is significant at 0.01 level (2-tailed), *Correlation is significant at 0.05 level (2-tailed)

particularly protein-energy malnutrition, which accounts for the high mortality of Nigerian children in this age bracket[19,20].

Overweight and obesity were prevalent at middle and advanced adulthood. Overweight was the most prevalent abnormal body weight with prevalence as high as 52% in males, 40-59 years and 40% in females, 60-75 years. Prevalence of obesity was also high, in females, 40-59 years (41.2%) and 25.0% in males, 60-75 years. Persons in the age bracket include senior academics and administrative staff who by reason of age and the demands of their jobs live sedentary lifestyle void of strenuous physical activity. Overweight and obesity have been linked to lack of physical exercise, excessive caloric intake, genetic factors, endocrine disorders and some medications[21].

The abnormal body weights, underweight, overweight and obesity, presented dissimilar patterns of prevalence. For underweight, the prevalence decreased progressively from its peak at early childhood to a least value at middle adulthood. On the contrary, overweight and obesity rose steeply at adolescence and early adulthood respectively to a peak value at middle adulthood. At advanced adulthood, prevalence of overweight and obesity declined while that of underweight increased. This study shows that there is a twain burden of underweight and obesity in Nigeria. Underweight is prevalent in children, particularly those under-five years whereas the prevalence of overweight and obesity is high in middle and advanced adulthood. This follows the pattern observed in many developing countries[2-4]. Health education and interventions such as nutritional improvement and structured physical exercises are needed to reduce the incidence of underweight in children and obesity in adults.

Age strongly correlated with height, weight, BMI and body weight status of the participants. Gender on the other hand influenced weight and height but not the BMI and body weight category.

CONCLUSION

There was strong association between age and body weight in the population studied. Age had greater influence on all the anthropometric parameters compared to gender. Underweight and obesity occur together in the Nigeria community. Underweight was prevalent in early childhood whereas overweight and obesity predominated at middle and advanced adulthood. There is high risk of weight-related ailments in under-five children and middle aged persons. Age and gender should be considered in the efforts to tackle the nutritional and health challenges of Nigerians.

SIGNIFICANCE STATEMENT

The study showed a strong association between age and body weight in the population. Age had greater influence on all the anthropometric parameters compared to gender. There is high risk of weight-related ailments in under-five children and middle aged persons. Age and gender are important factors that should be considered in tackling the nutritional and health challenges of Nigerians, particularly for the under-five and middle aged.

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